

REMARKS

The Examiner is thanked for carefully reviewing the present application. The present amendment is in response to the Office Action mailed on March 9, 2005 regarding claims 1-50 (but not claims 1-51). The applicant has thoroughly reviewed the outstanding Office Action including the Examiner's remarks and the references cited therein. The above amendment and following remarks are believed to be fully responsive to the Office Action and render all claims at issue patentably distinguishable over cited references. Favorable reconsideration is requested in view of the following remarks.

Claims 1, 5 and 42 are amended to rewrite the feature of parsing the new wave-shape border to independent claim 1 and dependent claim 42 for more clarifying the irregular shape, according to Figures 2A to 4. Claims 1, 5 and 42 are amended to further define the range of the new wave-shape border. Claims 10 and 45 are canceled. Claims 1-9, 41-44 and 46-50 are now pending in the application. These amended claims contain no new matter nor raise new issues.

Claim Rejections under 35 U.S.C. §102(a)

Claims 1-5, 10, 41, 42, 45, 48, 49 and 50 (but not 1-5, 10, 41, 46, 49, 50 and 51 referred by Examiner) are rejected under 35 U.S.C. § 102(a), as being anticipated by Ito (US Patent Publication No. US 6,583,442) (hereinafter referred to as "Ito"). Nevertheless, the Applicants respectfully disagree with the Examiner's rejection to the extent that the claimed invention is expressly or inherently anticipated by Ito.

In order to solve the issue that electric current flowing from a p-type layer through the light emitting layer to an n-type layer hardly flows evenly through each part of the light emitting layer, Ito's patent discloses a light emitter including a substrate, at least one semiconductor layer of a first conductivity type formed on the substrate, at least one semiconductor layer of a second conductivity type formed on a partial region of the semiconductor layer of the first conductivity type, a first bonding electrode connected to the semiconductor layer of the first conductivity type and a second bonding electrode connected to an almost entire surface of the semiconductor layer of the second conductivity type, wherein the substrate is transparent to light emitted from a proximity of a junction between the semiconductor layer of the first conductivity type and the semiconductor layer of the second conductivity type, the second bonding electrode is formed to have an almost rectangular shape and a substantially minimum area for bonding, and sides of the emitter are disposed in three directions of the circumference of the second bonding electrode.

However, the claim 1 of the present invention discloses a light emitting diode (LED), comprising: a semiconductor layer of a first polarity; an active layer, located on the semiconductor layer of the first polarity; and a semiconductor layer of a second polarity, located on the active layer, wherein at least one side of at least the active layer and the semiconductor layer of the second polarity has a wave-shape border in a top view of the LED, thereby reducing the probability of reflecting the light emitted from the active layer, thus making light emitted from the active layer penetrate through the at least one side and be emitted outside the LED. The claim 5 of the present invention further discloses that the wave-shape border in the top view of the LED is selected from a group consisting of triangular wave-shape border, semicircular wave-shape border, and parabolic wave-shape border.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Indeed, there are several features of the present invention that are not anticipated by Ito's patent. For example, in regard to the LED of the present invention, the wave-shape border of the at least one side of at least the active layer and the semiconductor layer of the second polarity in a top view of the LED, and the at least one vertical injection valley of the contact layer 155, the semiconductor layer 150 of the second polarity, and the active layer 140 (even including a portion of the semiconductor layer 130 of the first polarity), are not anticipated by Ito's patent. However, according to Ito's patent, “each of these semiconductor layers taught by Ito's patent is preferably formed into a rectangular shape because the outward shape of an LED chip is usually rectangle”. Moreover, “the "rectangular shape" of Ito's patent includes a square shape, a trapezoid shape, a parallelogram shape in addition to the rectangular shape and further includes these shapes with a part or all of the edges thereof being rounded, i.e., a shape near a semicircle, a shape near a semioval and the like so that these semiconductor layers can be disposed without wasting space in the LED chip” (the column 4, line 61 to the column 5, line 2). In other words, one or more corners of the LED chip of Ito's patent may be rounded. In addition, Ito attempts to minimize the bonding area of the second bonding electrode and dispose sides of the emitter in three directions of the circumference of the second bonding electrode, for improving the light emitted just under the second bonding electrode.

The Federal Circuit reiterated that “a rejection for anticipation under section 102 requires that each

and every limitation of the claimed invention be disclosed in a single prior art reference.” In re Paulsen, 31 USPQ 2d 1671 (Fed. Cir. 1994). Accordingly, in accordance with Ito’s patent, the aforementioned features as set forth in Claims 1 and 41 of the present application are neither expressly nor inherently described. Since nowhere in Ito’s patent is taught or suggested a LED in terms of the wave-shape border of the LED chip and the configuration of sides of the emitter of the present invention as claimed by claim 1 and 41, the present invention cannot be anticipated by Ito’s patent. Thus, this rejection is believed to be in error for the reasons stated above.

Since claims 1 and 41 is allowable, claims 10 and 45 are canceled, dependent claims 2-5, 42, 48, 49 and 50 each of which depends from independent claims 1 and 41 are likewise believed to be allowable.

Accordingly, the applicants respectfully request that the section 102(a) rejections be withdrawn.

Claim Rejections under 35 U.S.C. §103(a)

In the Office Action, claims 6-9, 43-44 and 46-47 (but not claims 6-9, 44, 45, 47 and 48 referred by Examiner) are rejected under 35 U.S.C. §103(a) as being obvious over Ito in view of Sugimoto et al. (JP 04-061,184). Reconsideration and notice to that effect is respectfully requested.

In order to provide a surface luminescent semiconductor laser having low threshold current and high light emission efficiency, Sugimoto’s patent discloses a surface luminescent semiconductor laser and manufacture thereof. Specifically, a semiconductor column (6) is formed as a light emitting region surrounded by a ring-shaped groove (7) reaching a quantum well active layer (9), and a modified layer (disordered region) (8) is formed only in the vicinity of the SiO₂ film (5) on a side surface of the groove (7). A polyimide (13) filled in the groove (7) is employed to enhance the insulating function. It will also be appreciated by one of ordinary skill that the groove (7) and the polyimide (13) filled therein is employed to provide insulation for decreasing the parasite capacitance between the upper electrode (10) and the lower electrode (11).

However, in the present specification, the contact layer 155, the semiconductor layer 150 of the second polarity, and the active layer 140 (even including a portion of the semiconductor layer 130 of the first polarity) in the present invention further have at least one vertical injection valley (page 8, lines 1 to 4). Furthermore, in the present specification of page 8, lines 6 to 14, and as shown in FIG. 3A and FIG. 3B,

the contact layer 155, the semiconductor layer 150 of the second polarity, and the active layer 140 (even including a portion of the semiconductor layer 130 of the first polarity) therein have a valley 202, a valley 204, a valley 206, and a valley 208, etc. penetrating from an upper surface of the contact layer 155 to a lower surface of the active layer 140 and reaching into a portion of the semiconductor layer 130 of the first polarity, even penetrating the whole thickness of the semiconductor layer 130 and reaching to an upper surface of the substrate 110, thereby increasing an efficiency of emitting the light emitted from the active layer 140 to the outside of the LED 180. In other words, the valley disclosed by the present invention is very different in its structure or function from the groove disclosed by Sugimoto's patent.

With regard to claims 8, 9, 46 and 47, Sugimoto's ring-shaped groove is not mainly employed to increase an efficiency of emitting the light emitted from the active layer to the outside of the LED. Instead, Sugimoto's ring-shaped groove is employed to lower threshold current. Moreover, a modified layer (disordered region) is formed only in the vicinity of the SiO₂ film on a side surface of the groove. In other words, Applicant's valley is very different in its structure or function from Sugimoto's ring-shaped groove. With regard to claims 8, 9, 46 and 47, just as described above, since Ito and Sugimoto et al. do not disclose the structure and function of Applicant's valley, the valley as claimed in claims 8, 9, 46 and 47, Ito in view of Sugimoto et al. do not teach or suggest the feature recited in claims 8, 9, 46 and 47. Accordingly, claims 8, 9, 46 and 47 are likewise believed to be allowable.

With regard to claims 6 and 43, just as described above, since Ito and Sugimoto et al. do not disclose the structure and function of Applicant's valley, the deformed dimension as claimed in claims 6 and 43, Ito in view of Sugimoto et al. do not teach or suggest the feature recited in claim 6 and 43. Accordingly, claims 6 and 43 are likewise believed to be allowable.

With regard to claims 7 and 44, just as described above, since Ito and Sugimoto et al. do not disclose the structure and function of Applicant's valley, the incident angle of the light emitted from the active layer to the at least one side as claimed in claims 7 and 44, Ito in view of Sugimoto et al. do not teach or suggest the feature recited in claims 7 and 44. Accordingly, claims 7 and 44 are likewise believed to be allowable.

"To combine references to reach a conclusion that claimed subject matter would have been obvious, there must be some teaching, suggestion, or inference in either reference, or both, that would have led one of ordinary skill in the art to combine the relevant teachings of the references. Absent such

reason or inferences, the teachings of the references are not combinable." *Ex parte Skinner*, 2 U.S.P.Q. 2d 1788 (B.P.A.I 1986)

As the present invention and the applied art are directed toward solving different problems, having different structures, and yielding different results, claims 6-9, 43-44 and 46-47 cannot be regarded as being obvious over Ito in view of Sugimoto et al. Reconsideration and withdrawal of this section 103(a) rejection are respectfully requested.

CONCLUSION

In light of the above remarks, all objections and rejections having been addressed, it is respectfully submitted that the present application is in a condition for allowance and a Notice to that effect is earnestly solicited. If there are any remaining issues to be resolved, the applicants request that the Examiner contact the undersigned attorney for a telephone interview.

Respectfully submitted,

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